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India's Export-Led Growth: Exemplar and Exception

SHOUMITRO CHATTERJEE AND ARVIND SUBRAMANIAN*

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Two new facts motivate this long-run assessment of India's exports and growth. First, since the early 1990s, India has posted the world's third-highest growth rate in overall and manufacturing exports, which has been critical to India's overall growth performance. Contrary to perception, India has been an exemplar of the export-led growth model. Second, this aggregate performance has, however, co-existed with an underperformance in unskilled manufacturing exports. This has resulted in at least $140 billion in "missing" unskilled economic activity annually. A cross-country gravity perspective suggests that India is a "normal" exporter and importer of goods and services, but an under-exporter of manufacturing goods. Going forward, India's unusual, endowment-defying specialization could limit export dynamism. Having not traversed the Lewis curve for unskilled manufacturing, the curve for skilled exports is threatening to turn up as skilled labor becomes scarce.

Keywords: Globalization, Exports, Economic Development

JEL Codes: F6, O1

*Chatterjee: Pennsylvania State University, University Park, PA, USA. Email: sc20@psu.edu. Subramanian: Ashoka University, Sonepat, HR, India. Email: arvind.subramanian@ashoka.edu.in.This paper builds upon our piece for the Peterson Institute for International Economics volume on US-India trade relations. We are grateful to our PIIE colleagues, participants at seminars at Ashoka University, the Centre for Policy Research, and the Institute for Economic Growth, and Abhishek Anand, Sajid Chinnoy, Rana Hassan, Pravin Krishna, Aaditya Mattoo, Sutirtha Roy, Navneeraj Sharma, and especially Rohit Lamba and Dani Rodrik for valuable comments and discussions. Gordon Hanson pointed us to useful data sources. David Xu provided excellent research assistance. We are particularly grateful to Josh Felman for several discussions on this topic over many years. All remaining errors are our own.

1. Introduction: India as an East Asian Tiger

Although its causes and policies are contested, it is beyond doubt that a number of East Asian countries—Japan in the 1950s, South Korea, Hong Kong, Taiwan, and Singapore from 1960 onward, China after 1978, and most recently Vietnam after 1990—have exemplified phenomenally successful export-led growth strategies. Owing to their export and growth success, these countries have deservedly been described as the "East Asian Tigers."

It has been four decades since India's own growth acceleration began. In this paper, we document that India's overall export and growth performance in the last three decades has been East Asian Tigeresque, but with a difference. Similar to the East Asian Tigers, India's manufacturing export growth has been exemplary. Between 1995 and 2018, India ranked third in the world in terms of manufacturing export growth, bettered only by China and Vietnam. However, India's experience has been different from the East Asian experience—despite being a low-skill labor abundant country, India's exports of high-skill manufacturing goods and services grew more rapidly than low-skill manufacturing exports such as apparel, textiles, leather, and footwear. Most models of international trade would have predicted the opposite.

These facts are important because they run contrary to accepted beliefs. The mainstream view about India is that it is not a paragon of export-led growth. India's export performance, if at all, is services-driven and not driven by manufacturing (Rodrik, 2015).[1] Given service exports' limited scope and recent origin, they cannot explain India's overall dynamism. We show that in reality, exports have been highly correlated with and critical to India's growth over the last three decades. The portrait of a reluctant trader encumbered by its dirigiste past is true only for the 1980s.

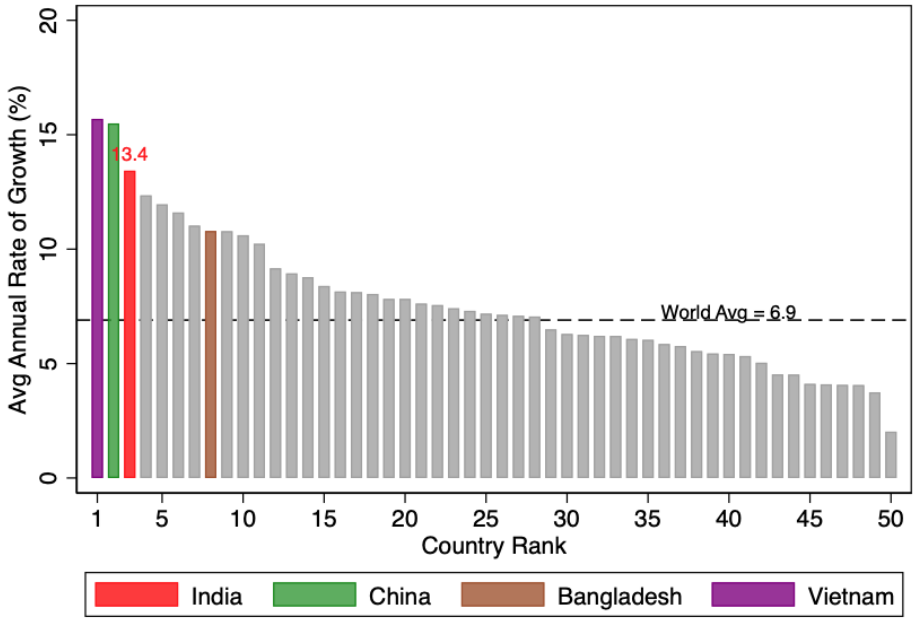
These facts are also important for current policy. Over the last few years, India has turned inward. Policy is moving closer to a development strategy led by import-substitution in a deglobalizing world. The import substitution has been sustained by average tariff increases of close to 5 percentage points since 2017. Facts that highlight trade's contribution to India's growth will better inform the policy debate on this inward turn (for details see Chatterjee and Subramanian, 2020b).

[1] The finding that India is a classic "premature de-industrializer" conveys the strong sense that its manufacturing performance and hence manufacturing export performance have fallen behind.

Figures 1–3 illustrate the proposition that India's rapid export growth and exports' sizeable contributions to India's overall growth have established India as an exemplar of the export-led growth model. Between 1995 and 2018, India's overall export growth has averaged 13.4 percent annually, the third-best performance in the world among the top 50 exporters, nearly twice the average world growth (Figure 1a) and not far behind China's growth of just over 15 percent.

Contrary to wide belief, this export growth is not just because India is a services-exporting powerhouse. Over the same period, India's manufacturing exports—long considered to be India's Achilles heel—grew on average by a whopping 12.1 percent, the third-best performance in the world and nearly twice the world average (Figure 1b). Only China and Vietnam have surpassed India in export growth.[2]

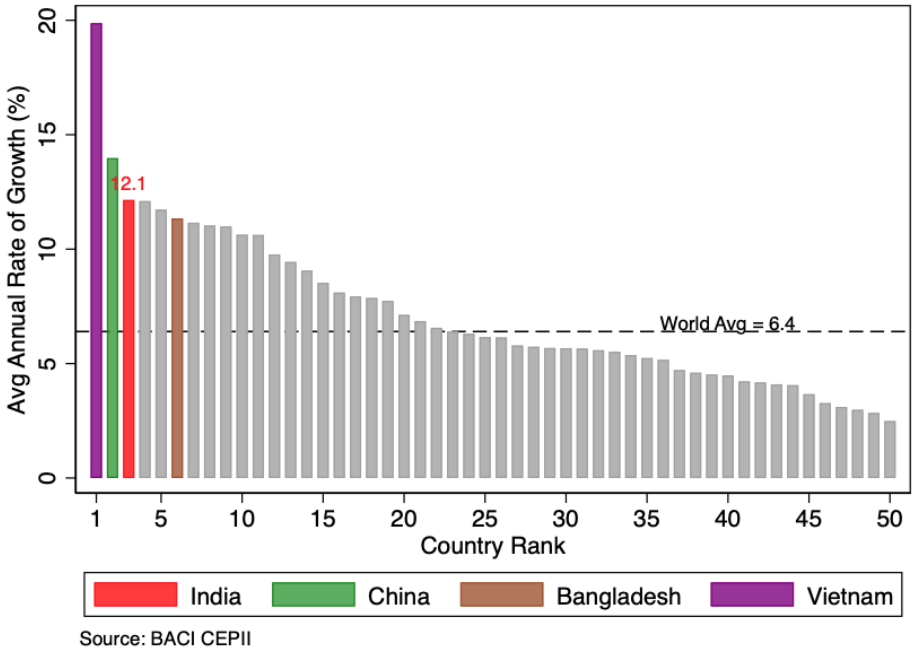
Figure 1a. Export Growth of Goods and Services 1995–2018



Source: World Development Indicators. Exports of Goods + Non-Factor Services

[2] We have reported export growth rates based on current dollar values in order to be consistent with the analysis on global market shares that comes later in the paper. However, re-running these calculations based on "real" exports of goods and services or merchandise export volumes yields almost identical results. The first decade of our analysis of exports starts in 1995 because the BACI data start in that year.

Figure 1b. Exports Growth of Manufactured Goods 1995–2018



Source: BACI CEPII

Figure 2 highlights that this export growth performance is not due to external factors alone and that it has been broadly true over three decades. Figure 2 plots growth of Indian (red) and world exports (blue) and the excess growth of Indian over world exports (green). We refer to the last component as change in global market share (hereinafter GMS).[3] Intuitively, if Indian exports grow faster than average world exports over longer horizons, that must owe to domestic supply-side factors such as productivity growth. Thus, whereas a positive world growth of exports reflects (external) demand-side factors pulling Indian exports, a positive change in GMS reflects domestic supply-side factors pushing Indian exports.

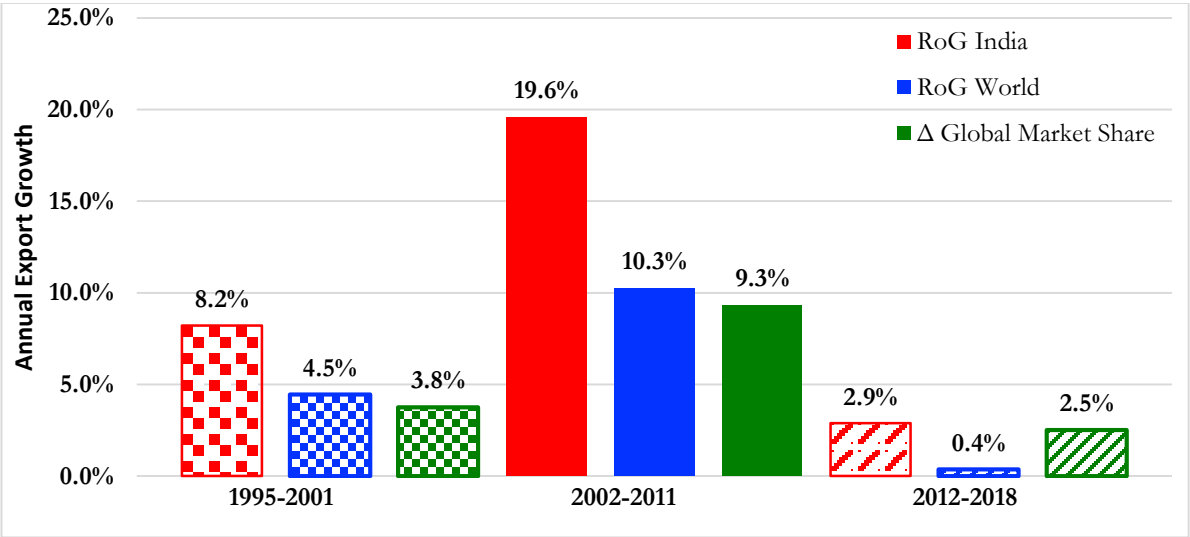
Figure 2 illustrates that in the 1990s and especially the 2000s, India's exports were growing not just rapidly but were also growing more rapidly than world exports and hence gaining global market share. Even in the 2010s, after the global financial crisis (hereinafter GFC), Indian exports still gained global market share even though overall export growth had collapsed.

[3] To avoid confusion, we report the change in global market share as the excess of the growth of domestic exports over global exports in each category. Thus, the unit of change in the global market share is percent, not percentage points. The latter will, of course, depend on India's initial level of global market share in percent. A 10 percent change in GMS as we compute it will translate as a 0.1 percentage point gain in market share if India's initial GMS is 1 percent.

In the boom period of the 2000s, India was the world's fasting growing exporter; in the 1990s and 2010s, it ranked in the top ten exporters as measured by export growth. In other words, since the 1990s, India has been one of the most successful exporters, gaining market share in each of the three decades: in the first decade of the twenty-first century, India's success was extraordinary, and even in the most recent period of collapsing world exports, its success has been highly respectable. Unsurprisingly, export growth is also reflected in per capita GDP growth as India's global GDP rank among the 72 major non-oil economies of the world, was 11, 4, and 8 during 1995–2001, 2002–2011, and 2012–2018, respectively.[4]

Having established that export performance in this period was stellar and not externally driven, we next argue that export growth was also important in sustaining overall GDP growth. Figure 3 shows India's growth in the four decades of rapid growth (the 1980s through the 2010s) along with the demand-side correlates of growth: exports, investment, and government expenditure. Focusing on investments and exports, the four decades fall in two broad patterns.[5] Investment plays a significant role in the first three decades, while exports play a significant role in the last three. A pseudo-growth decomposition in Table 1 confirms this role of exports. [6]

Figure 2. Export Growth Decomposed into External Factors and Gain in Global Market Share



Source: BACI CEPII. ΔGMS equals India growth minus World Growth.

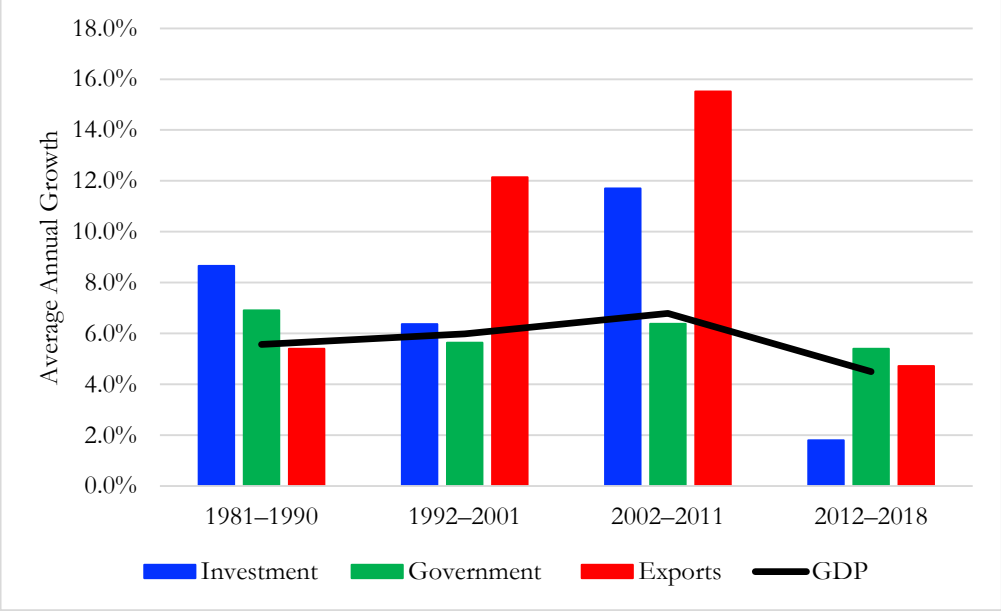
[4] For India, these ranks are based on using the official 2004–05 GDP series for the 2002–2011 period and the estimates in Subramanian (2019a, 2019b) for 2012–2018. See Section 2.2 and Appendices 3 and 4 for further details.

[5] We do not include consumption for two reasons: the pragmatic one is that the mismeasurement in GDP affects consumption, especially for the last two decades, and hence misleading for analysis (see Appendix 4). The more conceptual reason is that consumption is likely to be more endogenous to income than the other demand correlates, although supply factors could be driving all these correlates.

[6] The term "pseudo" is used because, as discussed in footnote 4, we exclude consumption from the analysis.

In the 1980s, exports contributed very little to growth both because export growth was modest and because exports accounted for only about 6 percent of GDP. In the 1990s, exports' contribution rose, with export growth accelerating to 12 percent. In the next decade, export growth accelerated to an average of more than 16 percent in real terms, significantly contributing to overall growth. (By this time, exports accounted for about 32 percent of GDP). In this period, rapidly rising investment growth also largely contributed to overall GDP growth. And in the most recent decade, consistent with the decline in GDP growth, export growth slowed sharply to average only about 4.7 percent, while investment collapsed.

Figure 3. Evolution in Demand Correlates, 1980–2018



Source: World Development Indicators (WDI). Notes: Exports include goods and non-factor services. Nominal Government expenditure is deflated by the consumer price index. The GDP growth estimate for 2012–2018 is from Subramanian (2019a, 2019b).

Table 1. Contribution to Growth of "Exogenous" Demand Components

Period	Government consumption	Investment	Exports	Government consumption	Investment	Exports
	percentage points			*share of total*		
1981-1990	0.71	1.48	0.32	28%	59%	13%
1992-2001	0.77	1.55	0.79	25%	50%	25%
2002-2011	0.90	3.14	1.94	15%	52%	32%
2012-2018	0.66	0.73	0.73	31%	35%	34%

Source: World Development Indicators. Notes: Contribution is the growth of the relevant aggregate (in real terms) multiplied by its initial share in total GDP; Government consumption and investment are obtained by deflating the nominal series by the CPI deflator because the GDP deflator and CPI diverge dramatically in the post-2012 period (Subramanian, 2019b). For the period 2002–2011, data are from the official series using 2004–05 as the base. Appendix 3 reproduces this table for current official data.

The broader rising contribution of exports and trade is evident in measures of trade integration (see also Srinivasan and Tendulkar, 2003). In the 1980s, India's trade/GDP was stagnant at about 14 percent of GDP. It rose to 23 percent in the 1990s and accelerated to 43 percent in the boom period before declining and stagnating again in the mid-40 percent range in the 2010s.

In sum, from a macro-economic perspective, we can conclude that there are two broad models of growth. First, there was growth without exports in the 1980s, when growth was largely driven by rising investment and a large fiscal stimulus (Rodrik and Subramanian, 2005). Second, growth was closely linked to exports in the subsequent three decades. Whether we look at the evolution in exports (Figure 3), simple accounting contributions to GDP (Table 1), or correlations between exports and growth, it is evident that exports and trade (and real investment) played a critical role in India's growth, contributing to the acceleration in the 1990s and 2000s and the deceleration in the 2010s.[7]

Whether India's rapid increase in exports was the product of standard liberalization and deregulation—as happened from 1991 to the mid-2000s—or came through more heterodox policies like many of the East Asian countries or through more contingent factors (such as the rise of the IT sector) merits further research. But the outcome is clear: since the 1990s, India has been a fairly conventional poster child for the export-led model of growth.

Rodrik and Subramanian (2005) show that India's growth experience of the 1980s was unusual in that it delivered growth with limited reforms. Taking a long view, Lamba and Subramanian (2020) argued that India's development experience itself was distinctive in generating growth dynamism without delivering commensurate structural change. In this companion piece, we find that India's export performance seems special from a cross-country perspective. It is both an exemplar and an exception and as such offers potentially valuable lessons for other countries.

In the remainder of the paper, we will examine the sectoral performance of India's exports and highlight its uniqueness in a cross-country perspective. In the next section, we describe the theoretical lens that we use to analyze India's performance and details about the data. In Section 3, we establish that Indian export growth

[7] The correlation between real exports and real GDP growth, which is weak or negative in the 1980s (0.15) and is positive and strong (close to 0.6) until just after the GFC, confirms the contribution of exports. In fact, the correlation between exports and growth is weak and negative (−0.1) for the pre-1980 period.

was dominated by high-skill goods rather than low-skill goods contrary to predictions of theoretical trade models. This has not only resulted in missing economic activity of $60-140 billion but also contributed to India's missing export opportunities in the post-GFC period. In Section 4, we discuss, from a cross-country perspective, whether India is an under-exporter. Then, in Section 5, we highlight the implications of our findings for India's future.[8]

2. Data, Definitions, and Conceptual Framework

2.1 Data

The main source for trade data used in this paper is the BACI dataset produced by the Centre d'Etudes Prospectives et d'Informations Internationales (CEPII) in Paris. The dataset is built from UN-COMTRADE, but the CEPII has developed a procedure that reconciles the declarations of the exporter and the importer, that makes the data more reliable. The data are restricted to the years 1995–2018. We use data on the export of services from the IMF, which we complement with world development indicators data from the World Bank. The WDI data are used when we analyze years before 1995. To measure the skill content of any sector, we use data on revealed human capital intensity in exports for the year 2000 from UNCTAD and data on wage bills and value added in US NAICS sectors from the National Bureau of Economic Research's manufacturing industry database. We use NAICS-HS concordances from Pierce and Schott (2012). Data on gravity variables are obtained from the CEPII-Gravity dataset. We also use two deflators: the US GDP deflator from FRED and the Indian Consumer Price Index from the Reserve Bank of India. For our core analysis we consider two groups: the top 50 non-oil exporters in the world and the 72 major non-oil economies. Appendix 1 provides the list of these countries. One major country not reported is Taiwan, as UN agencies and thus COMTRADE do not collect direct data on Taiwan.

2.2 Indian GDP for the period of 2012–2018

Official Indian GDP estimates for the period of 2012–2018 are highly mismeasured. If the official growth numbers are right, India would have experienced high and rising growth despite a massive collapse in all the exogenous drivers of demand, by about 10 percentage points per year in both exports and investment (Mehra, 2019). Subramanian (2019a, 2019b) argues that not only is this directionally implausible and would consequently yield a development model of high overall growth despite weak growth in exports and investment and government spending, it would also yield implausible estimates of consumption growth that

[8] In a companion paper, we discuss the implications of our findings in this paper for India's development choices in regard to inward orientation (Chatterjee and Subramanian, 2020b).

are at complete variance with other direct data on consumption. Appendix 4 discusses these issues in greater detail.

2.3 Trade models

To study Indian's trade performance, we will use two broad frameworks from international trade theory. We will view India's pattern of specialization and the exceptionalism therein from the lens of the Hecksher-Ohlin trade model and the theory of comparative advantage. This would suggest that India's specialization and export patterns should be commensurate with its factor endowments. To analyze India's relative performance as an exporter in a cross-country perspective, we will use the lens of the gravity model, which of course can be micro-founded in several ways (e.g. Armington 1969; Krugman 1980; Eaton and Kortum 2002; Chaney 2008). This will allow us to assess the magnitude of international trade while accounting for country size and other geographic factors.

2.4 Definitions

To classify any HS-2 digit sector *s* into low-skill and high-skill categories, we define the following index of skill intensity:

$$Skill\ Intensity_s = \frac{Revealed\ Human\ Capital\ Intensity_s}{Share\ of\ wages\ in\ value\ added_s}$$

The numerator (obtained from UNCTAD) is higher for sectors whose exports come mostly from countries that have more years of education on average. The denominator controls for the labor share in that sector as per the US production function. Thus, a sector *s* has higher skill intensity if products in that sector are mostly exported by countries with higher education levels (where, skilled labor is presumably used) or the sector has a lower labor share in production. The numerator is an indicator of skill level, whereas the denominator is an indicator of the technology.[9] Any sector *s* whose index is above its median value is classified as high-skill; otherwise, they are classified as low-skill. The results broadly align with intuition, as clothing, textiles, leather, and footwear are classified as low-skill, whereas auto and auto parts, electronics, machinery, pharmaceuticals are classified as high-skill. The complete list of sectors falling into our two skill categories is in Appendix 2.

[9] This index is inspired by and is a variant of the PRODY index constructed by Hausman, Hwang and Rodrik (2007). The denominator is intended to control in part for the physical capital intensity of each sector. If, for example, the human capital requirement for two sectors is the same but one sector employs more people than the other, the index should capture that difference. Although the denominator is based on the United States, where optimal labor choices will be influenced by better technology, we expect that the relative rankings of sectors will not be unduly affected.

A skill intensity index can be computed in other ways. For example, we could just use the numerator (revealed human capital intensity) without correcting for the denominator in the spirit of Hausman, Hwang, and Rodrik (2007). This index has a rank correlation of 0.81 with ours and changes the classification of 11 sectors that account for less than 5 percent of total exports. We re-ran all our analyses using just the revealed human capital intensity index and our results remained robust.

3. Defying Comparative Advantage: $60–$140 Billion in "Missing Unskilled Activities"

Given India's large population and endowment of relatively unskilled labor, we would expect—and most trade models would suggest—that India's global presence in unskilled labor manufacturing would be broadly commensurate with those endowments.

A simple way of checking that expectation is to see whether India's share of global low-skill manufacturing goods is roughly proportional to its global share of unskilled labor. Since we must broadly compare like-with-like, we undertake this comparison for the subset of our 50 major exporting countries sample that are low and middle income because these are the countries that are likely to compete with India in producing and exporting low-skill manufacturing. [10]

Figure 4a shows one aspect of a comparison between endowments and outcomes. The y-axis shows a country's share of low-skill exports, and the x-axis shows a country's share of the global unskilled labor force. We expect that countries should line up roughly along the 45-degree line so that outcomes, meaning, the share in the unskilled manufacturing exports, are close to endowments, meaning, the share in labor force.[11]

The results are striking. China and India are stark outliers but in opposite directions. India's share of the global labor force far exceeds its share of low-skill exports. For China, it is exactly the reverse. India's share of global low-skill exports is about 15 percentage points less than its share of the labor force. The implication is that India is exporting about $60 billion less in low-skill exports annually than it should be.

[10] Excluding high-income countries as defined by the World Bank in 1987. Appendix 1 lists the low- and middle-income countries.
[11] Trade theory, including the Hecksher-Ohlin model, makes predictions about a country's *relative* endowment (unskilled versus skilled labor or labor versus capital) and the *relative* outcomes that result. This cross-country comparison is in that broad spirit and is validated by our gravity-based analysis in Section 9 below.

It could be argued that when comparing endowments and outcomes, the relevant outcome is not just exports but production.[12] Ideally, we should plot value-added of low-skill manufactured goods, but those data are unavailable. Therefore, in Figure 4b, we plot the relationship for the production of the most important unskilled labor-intensive sector, namely textiles and clothing.[13]

Figure 4a. Labor Endowment and Low-Skill Export Performance of Developing Countries in 2018

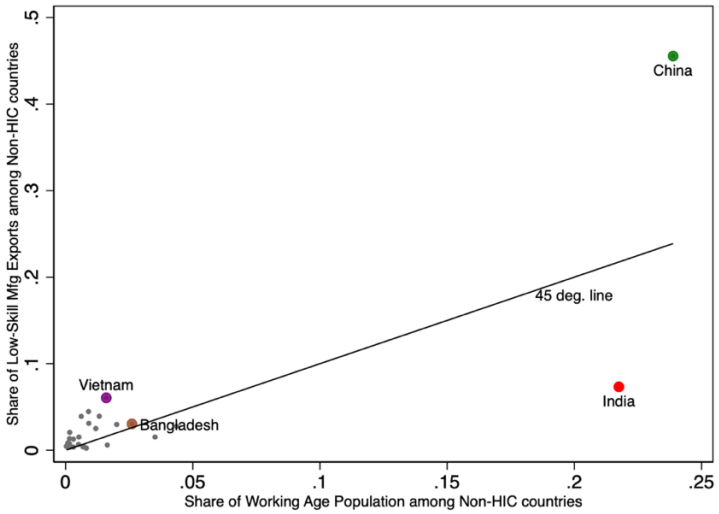
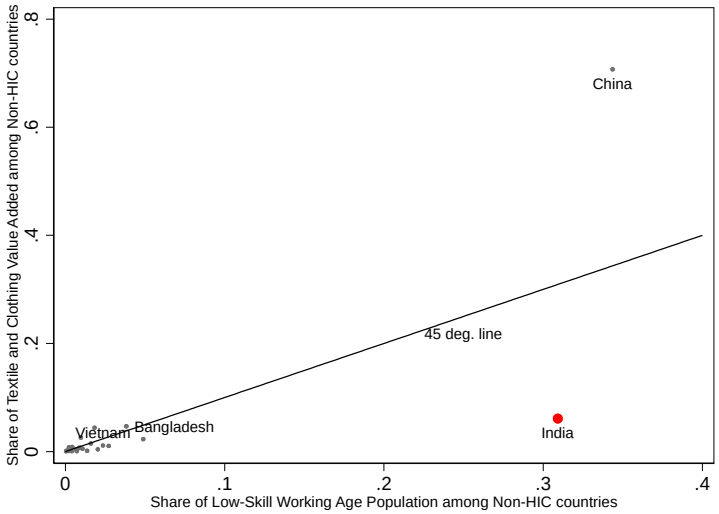


Figure 4b. Labor Endowment and Production Performance in Textiles and Clothing in 2018



[12] The Hecksher-Ohlin theorem is about relative endowments and exports but is based on the Rybczynski theorem, which relates relative endowments to output (Jones and Neary, 1984).

[13] Ideally, this chart should correct for each country's level of development because wages will be higher in richer countries and their effective unskilled labor force lower. But that will only make India fare worse because India is among the relatively poor countries in this sample. We get similar results when we plot this relationship between share in the global labor force and the share of the production of all manufacturing goods (results available upon request).

Figure 4b confirms India's comparative advantage–defying specialization and its consequences. India produces roughly $34 billion in textiles and clothing. If it were to produce in line with its labor force, the size of its domestic textile and clothing sector should be $174 billion. In other words, India's missing production in the key low-skill textiles and clothing sector amounts to $140 billion, which is about 5 percent of India's GDP.

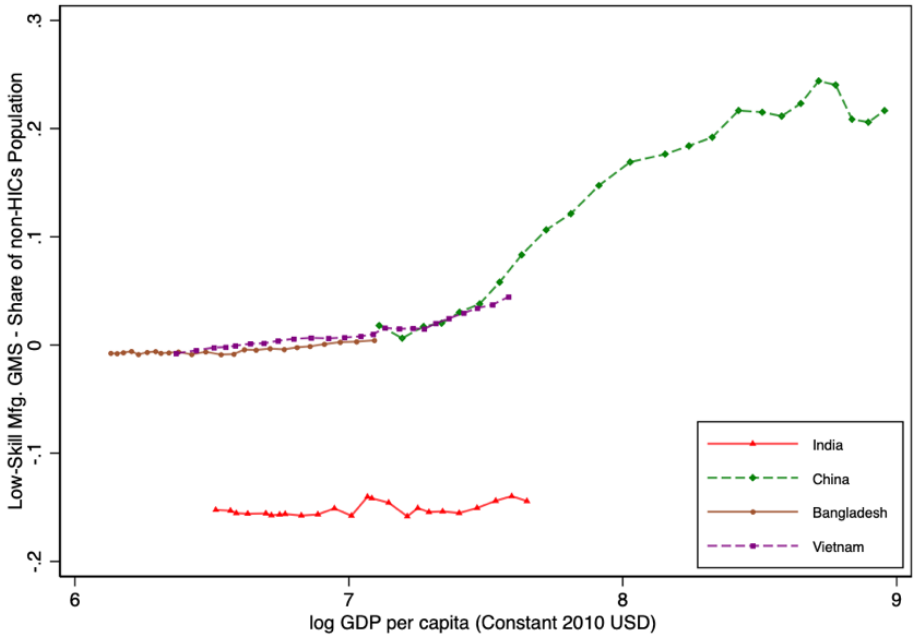
Figures 4a and 4b illustrate perhaps one of the most severe indictments of India's development model (and also the greatest tribute to Chinese performance). Although qualitatively, the comparative advantage–defying pattern of specialization in exports was known to some (Krishna, 2020; Panagariya, 2004), but the fact that production patterns are not commensurate with factor endowments was heretofore unknown. However, the real surprise is in the magnitudes, illustrative as they are, which show at least $60 billion in missing exports and $140 billion in missing production.

India's underperformance in low-skill manufacturing is a longstanding structural problem that goes back decades. While Figures 4a and 4b are based on the most recent data, Figure 5 plots a time series version. Figure 5 plots the wedge between the share of global unskilled exports and the share of the global work force on the y-axis since 1995 (with time measured in terms of a country's level of development). The plot is for four countries: India, China, Vietnam and Bangladesh.

Bangladesh and Vietnam export roughly in line with their endowments and have been doing so at least since 1995. China started as a normal exporting country, exporting in line with endowments; it then became a massive outlier on the positive side, exporting much more than its endowments. India, in contrast, has been a steady, consistent, and massive underperformer throughout the last 25 years, exporting about 15 percentage points less than what would be implied by its abundance of unskilled labor.[14]

[14] Is there a counterpart, or even an offset, to the missing $60 billion in low-skill exports because of overspecializing in skill-intensive exports? We conduct an exercise similar to that in Figure 4 to check whether India's share of high-skill exports was well above some measure of its share of the world's educated labor force. In this instance, we include both low-income and high-income countries. Our results (not reported) show that India is not a major overperformer, so there is no offset to the missing exports. However, these results are less definitive because cross-country data on educated labor forces are not accurate, are patchier, and do not correct for the quality of skill and education, making the data less reliable for making strong assessments. Results available from the authors upon request.

Figure 5. Gap between Global Share in Low-Skill Exports and Working Age Population in Development Time



Notes: The Y-axis plots the difference between each country's Global Market Share in low-skill manufacturing exports among non-High Income Countries (non-HIC) and its share in the non-HIC working population.

4. Reconciling Macro and Trade: Is India also Defying Gravity?

How can we reconcile the two facts discussed so far? On the one hand, Figures 1 and 2 point to India's spectacular overall export performance over three decades, the third best in the world. On the other hand, Figures 4 and 5 indicate that India is massively under-exploiting its abundant factor of production, unskilled labor, leading to missing economic activity of unskilled goods to the tune of $140 billion a year.[15] Is India doing well or poorly? Put more starkly, is India an over-exporter or under-exporter?

A first piece of evidence that helps reconcile these two findings comes when we decompose aggregate export performance into its sectoral pattern in Figures 1 and 2. A simple decomposition shows that change in overall GMS can be written as a weighted average of the change in sectoral GMS and the change in external demand-side factors. Empirically, we find the latter to be small and therefore focus on that aspect of performance that is driven more by domestic factors and report evidence on change in sectoral global market shares. The details of this decomposition are relegated to Appendix 5.

[15] We estimate missing production of $140 billion of textiles and clothing, and missing exports of $60 billion for low-skill manufacturing goods.

To keep the analysis both analytically meaningful and also presentationally tractable, we aggregate the detailed merchandise HS-2 data and services exports into five categories: agriculture, minerals, low-skill manufacturing, high-skill manufacturing, and services.[16] These broadly map into distinct sources of comparative advantage: land for agriculture, resource endowments for minerals, and labor endowments for manufacturing and services.

Figure 6 plots the four analytical sectors and the key low-skill manufacturing sectors of apparel, textiles, leather, and footwear to show the change in global market share across the three decades.[17] India's exports perform well in that they gain global market share in all sectors.[18]

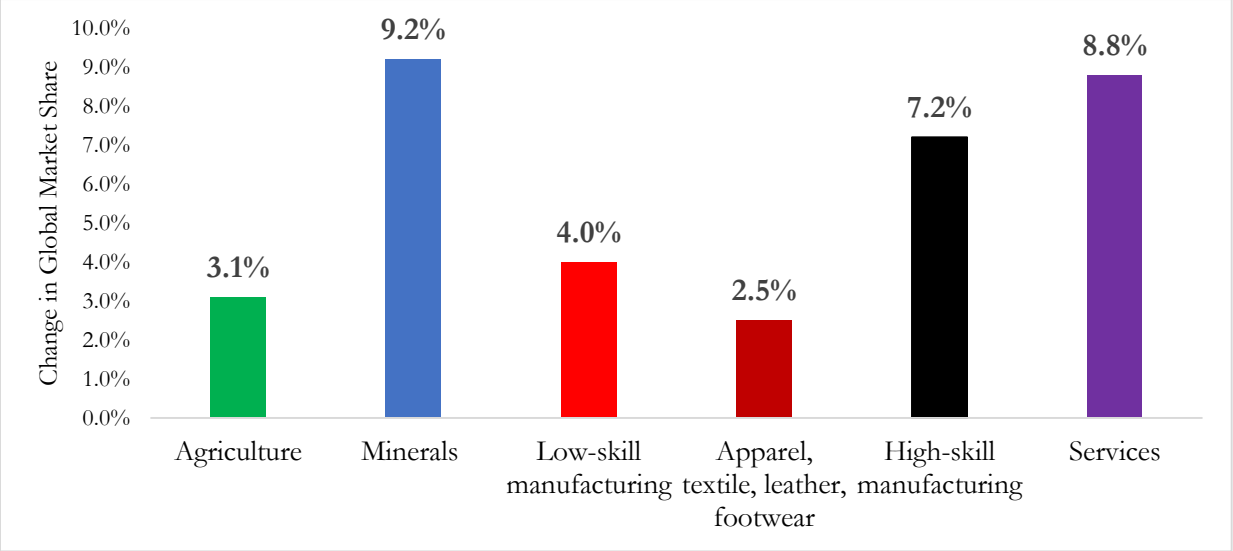
What is striking is that high-skill manufacturing and services outperform low-skill manufacturing and key sectors within that category by a large margin. It is not that low-skill manufacturing performs poorly in absolute terms because there are gains in global market share in this sector as well. Rather, low-skill manufacturing only performs moderately well and lags behind the high-skill sectors. Unskilled-labor-intensive sectors have performed worse than other sectors, especially high-skill manufacturing and services.

[16] In the Harmonised System (HS) of trade classification, manufacturing comprises all the sectors from sectors 28 to 96, oil and minerals comprise sectors 25 to 27, and agriculture comprises sectors 1 to 24. Raw Cotton (92) is classified in agriculture and not manufacturing.

[17] Specifically, we define change in global market share as the excess annual average Indian export growth over world export growth in each category.

[18] All these market share results are based on the value of domestic and global exports. Since they are calculated at an aggregate level, it is possible that unit values will move differently for India's export basket than for the global basket. (Indeed, this problem will arise even when computations are done at disaggregated HS-6 and HS-8 digits as shown by Schott (2004)). Specifically, for our results to be overturned, unit values for India's basket had to have grown consistently faster than those of the global basket. We are not sure how likely this is, but we cannot rule it out either. At least at the aggregate level, the growth indicators based on values move in line with those based on real quantities/volumes (footnote 4 above).

Figure 6. Change in Global Market Share by Major Analytical Sectors, 1995–2018



Notes: We define change in Global Market Share as excess growth of Indian exports over world exports.

This is a version of the "dog that did not bark": the aggregate good performance is misleading because the unskilled sectors should have performed differentially well. As a consequence of the relative underperformance of the low-skill sectors, India missed export opportunities in the post-GFC period. In Chatterjee and Subramanian (2020a), we estimate that China lost about $140 billion in global market share post-GFC. However, since the loss was mostly in unskilled labor–intensive products, India could capture very little of it.

The second and final piece of evidence that helps reconcile the two findings comes from a gravity-based analysis that focuses on openness indicators. Appendix 6 provides three openness indicators, all expressed as a share of a country's GDP: exports of goods, exports of goods and services, exports plus imports (trade) of goods and non-factor services. A naïve comparison of these indicators is misleading. India's export openness indicators are quite low—among the bottom quartile of countries—suggesting that indeed India is an under-exporter relative to other countries. However, this is also true about other large countries such as the United States, China, Brazil, Japan, and Indonesia—most of which are large exporters.

A more formal way of testing whether a country is an over-trader or an under-trader would be to view the trade data through the lens the gravity equation. Gravity equations, which can be micro-founded with many different trade models (e.g. Armington, 1969; Krugman, 1980; Eaton and Kortum, 2002; Chaney, 2008), are

one of the most stable empirical relationships in international trade that relate bilateral trade between countries to their GDPs and the distance between them. A key implication of the gravity equation is that all things being equal, large countries will have lower trade-to-GDP ratios (Krugman, 1995) and this cross-country relationship between trade-to-GDP and exports-to-GDP allows us to test whether a country is an over-exporter or an under-exporter.

To ensure that all else is in fact equal, we need to control for other aspects that could affect both a country's trade and its GDP. A key control is market access, which determines the economic size of partner countries and the geographic and policy distance from them. A country will trade more with large counties that are geographically closer to it. For example, Mexico will trade a lot with the United States because it is physically close and the two countries have a free trade agreement, and Poland will trade a lot with Germany because of its proximity to Germany and the European Union.

Other controls include determinants of GDP such as geography, institutions, or technology (as in Goldberg and Reed 2020). Climate, distance to the coast, and ruggedness are geographic factors affecting long-run growth (Nunn and Puga, 2012; Sachs, 2001). Agricultural productivity proxying for the level of economic development (Lewis, 1954) and life expectancy at birth proxying for human capital and/or institutions can also affect long-run performance (Acemoglu, Johnson, and Robinson, 2001). See Appendix 7 for details.

We plot this for the most recent period (the average of 2015–2018). Figures 7a and 7b show how much a country trades as a function of its size after controlling for these factors. We plot this for two measures of trade: exports of goods (Figure 7a) and exports of goods and services (Figure 7b).

The consistent finding is that India's exports of goods is below what might be expected for its size and level of development (India is below the regression line in Figure 7a), but its overall exports (goods and services) and overall trade (goods and services) are consistent with its size and level of development: in Figure 7b, India is on the regression line. India is also on the regression line if we plot total trade instead of just exports in Figure 7b.

Figure 7a: Exports of Goods and Country Size, 2015–2018

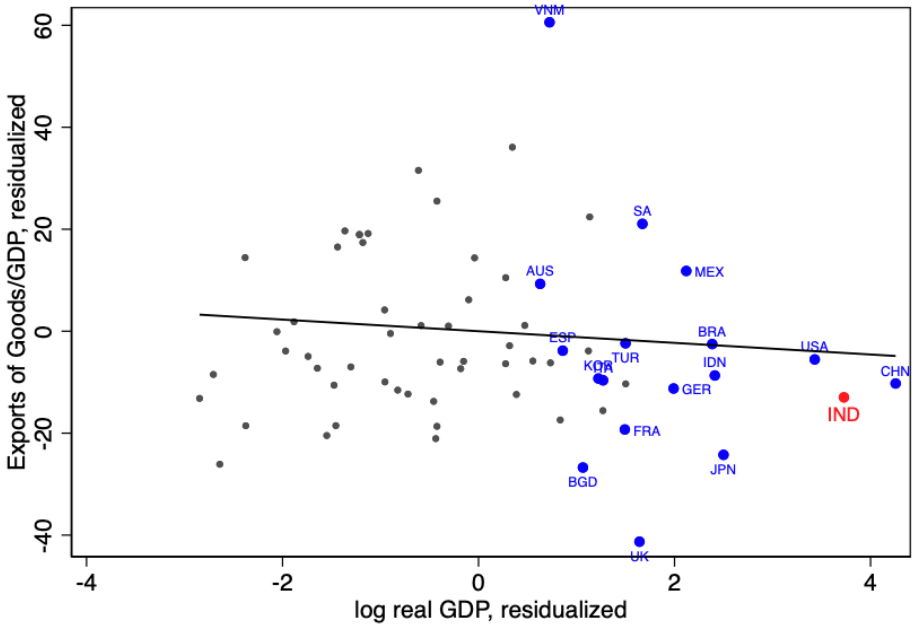
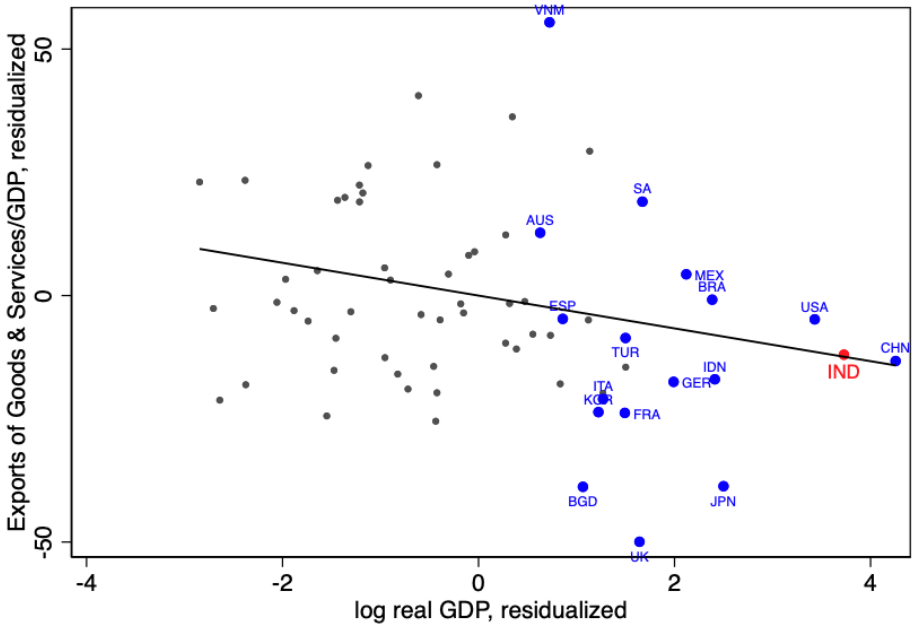


Figure 7b: Exports of Goods and Services and Country Size, 2015–2018



Notes: In Figures 7a and 7b, the scatter plot of Singapore and Hong Kong are omitted but they are used to estimate the regression line

This underperformance on exports of goods helps reconcile the two new facts. India's underperformance on unskilled labor exports has been structural and long run and has not been offset by even the three-decades long dynamism in exports of goods, especially since that three-decade performance was not particularly pronounced in unskilled labor–intensive exports. If one includes services, then India ceases to be an under-exporter because the three-decade-long services export performance offsets the structural underperformance in unskilled goods imports.

On the import side, in goods and services, India has been a normal performer, so a gravity-based assessment suggests that India has been reasonably open on the import side but that notwithstanding, it has probably been an underperformer in relation to exports of goods because of its massive underperformance in relation to unskilled manufacturing. Thus, the imprint of the missing $140 billion in low-skill economic activity is evident in the data.[19]

5. Two Lewis Curves, One Untraversed, Another Traversed Too Quickly

We conclude with a perspective on exports that draws upon the insights of Sir Arthur Lewis and that also helps us understand India's future export prospects. Arthur Lewis saw economic development as a process of structural transformation, involving the massive redeployment of resources, especially the redeployment of people from low-productivity to higher productivity activities (Lewis, 1954). This redeployment could be quicker and more effective if the supply of labor was elastic, with a long, horizontal stretch corresponding to a modified version of a "subsistence wage,"— the Lewis curve—-so that real wages stayed below productivity growth (or unit costs rise slower than prices), ensuring the continuing profitability of the higher productivity activity (typically manufacturing).

China is, of course, the classic case of having traversed this elastic supply of labor in manufacturing for a relatively long time. This has enabled China to keep manufacturing exports competitive, which has allowed China to be an exporting powerhouse for a very long time.

One can think of India as facing two Lewis curves—one for unskilled manufacturing and one for skilled services. The discussion in the previous sections showed that India has failed to exploit the Lewis curve for unskilled manufacturing. Despite or because of not having done so, India's manufacturing skill intensity has

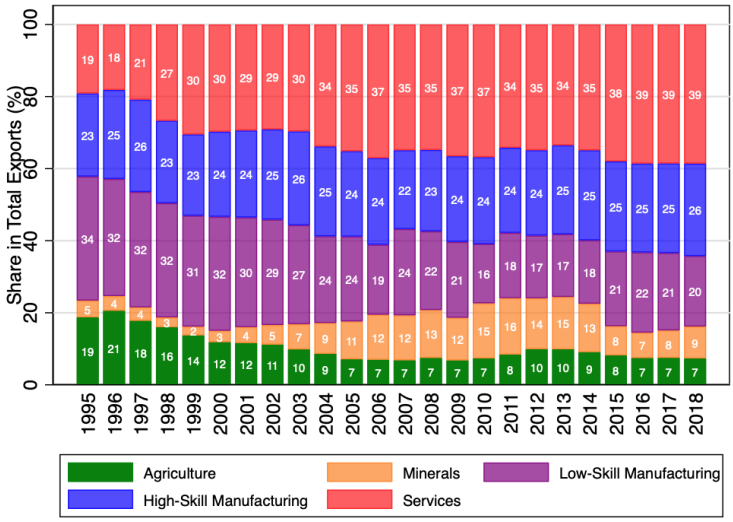
[19] More broadly, the endowments-based intuition of trade in Figure 4a appears consistent with the gravity-based intuition in Figure 7a.

sharply risen. The domestic counterpart is the low and even declining share of employment in manufacturing (Amirapu and Subramanian, 2015).

India's failure to traverse the Lewis curve for low-skill manufacturing is reflected in its structurally low level of unskilled manufacturing exports. The striking fact is that despite never having capitalized on its comparative advantage in low-skill manufacturing, India's specialization has become more skill-intensive, which is also reflected in its exports (Figure 5).

Figure 8 tracks the composition of Indian exports over time. Note that for a country like India that has abundant unskilled labor, the share of low-skill intensive exports (manufacturing) is low, whereas the share of high-skill intensive exports (manufacturing and services) is high and has been rising. Between 1995 and 2018, the share of low-skill intensive exports declined from about 34 percent to 20 percent. In contrast, skill-based exports have risen from 42 percent in 1995 to 65 percent in 2018.[20]

Figure 8. Sectoral Composition of India's Exports, 1995–2018



At one level, this changing structure is not inconsistent with a natural trajectory of development. As countries become richer, their specialization should change from unskilled to skill-based activities. But in India, both of the above trends are cause for concern. The reduction of low-skill intensive exports reflects failure more than success. The growth of high-skill intensive exports, while reflecting past success, portends future challenges. Put differently, the evolution of the sectoral composition of exports, provides clues to India's two potential

[20] We cannot say whether the tourism sector is high- or low-skill-intensive. However, since tourism accounts for a constant share of services (5 to 6 percent), the changes shown in Figure 8 will not be misleading.

long-run export vulnerabilities. The first vulnerability is India's inability to emulate the performance of China, Vietnam, and Bangladesh to become a powerhouse exporter of goods from relatively low-skill manufacturing sectors such as clothing and footwear. India's second vulnerability lies in its overreliance on skill-based exports—the underlying supply of skilled labor is limited, which makes reliance unsustainable over the medium term.

Figure 9 further illustrates the problem with India's export performance in manufacturing.[21] For India and the three recent low-skill export powerhouses (China, Bangladesh, and Vietnam) the figure plots an index that captures the skill intensity of aggregate manufacturing exports. For each country, we plot the overall skill intensity by weighting the index for each sector by its export share (shown on the y-axis) against its per capita GDP (on the x-axis). What is striking about the chart is both the level and change in this low-skill intensity export index. For its level of income, India's index is well above that of China, Bangladesh, and Vietnam, and over time, India's index rises and remains well above that of other countries whose exports have grown more rapidly. Therefore, in terms of is level and change, India's skilled export intensity is too high.

Of course, this high and rising skill intensity in itself need not have been a problem if it had been associated with high and rising exports. But as discussed earlier, these developments have been associated with poor performance in less-skilled exports, and change is unlikely in the future given India's revealed preference for specializing in higher-skill activities.

This revealed preference is also reflected in India's robust performance in services, which accounts for its rising global market share, which amounted to about 3 percent most recently (Figure 10). Going forward, it is possible that the offset for not exploiting the Lewis curve for manufacturing could be to exploit the Lewis curve in relatively skill-intensive services. But here too the pace at which India gained global market share declined sharply, from about 6 percent in 2002 through 2012 to about 2 percent thereafter. Of course, many factors are at play. But two possible factors include the inability of Indian firms to upgrade and adapt their basic IT model (see *The Economist*, July 23, 2020) and the increasing scarcity of the relevant skilled labor. The increasing scarcity of skilled labor suggests that India's Lewis curve for skilled labor has either turned up or is close to doing so. What happened to China after three to four decades in manufacturing could be happening to India two decades after the IT boom.

Figure 9: Skill Intensity of Manufacturing Exports against Per Capita GDP

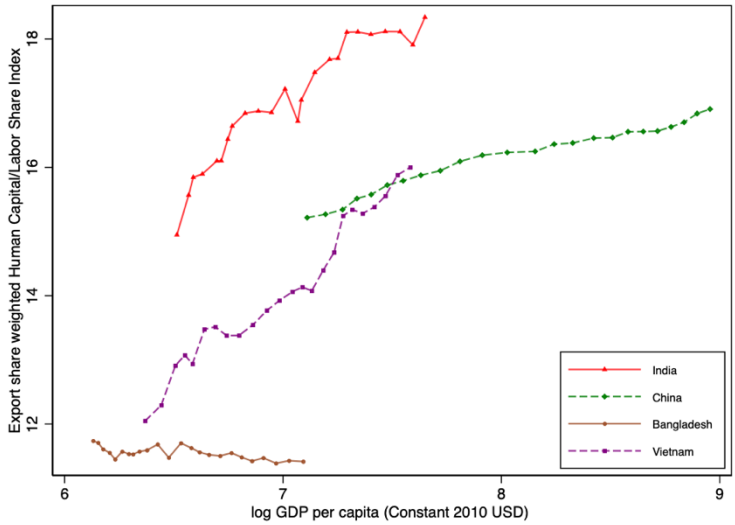
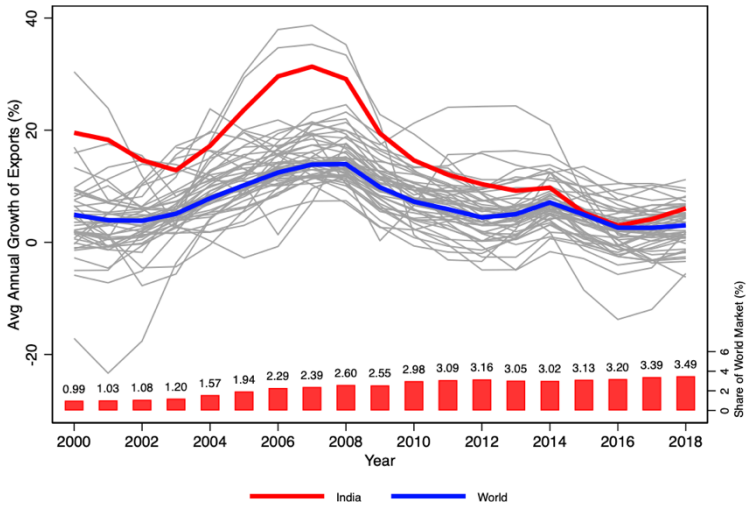


Figure 10. Services Export Growth



Notes: Export growth is calculated over 5-year rolling windows

A cautious conclusion is that the ability of India's export growth to outpace that of the rest of the world—as indeed it has done spectacularly for three decades—will be increasingly constrained. Both exports of manufacturing and services are skill-intensive and becoming more so, and if the quality and quantity of skills available to the economy starts slowing (rising Lewis curve), exports will run into domestic supply constraints. India's longstanding inability to export unskilled manufacturing products is an indictment but equally it is an opportunity, especially with China vacating export space in these products. An extraordinary policy effort will be required to exploit this opportunity. Equally, policies cannot afford to neglect the skill-intensive exports,

which are still dynamic but are losing steam. India must view these two Lewis curve developments as early warnings not unavoidable destinies.

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Appendix 1: Country Sample

50 major exporting countries from the CEPII-BACI data:

Argentina; Australia; Austria; Bangladesh; Belarus; Belgium; Brazil; Canada; Chile; China, P.R.; Hong Kong, China; Colombia; Czech Republic; Denmark; Finland; France; Germany; Greece; Hungary; India; Indonesia; Ireland; Israel; Italy; Japan; Korea; Republic of Lithuania; Malaysia; Mexico; the Netherlands; New Zealand; Norway; Peru; the Philippines; Poland; Portugal; Romania; Singapore; Slovak Republic; Slovenia; South Africa; Spain; Sweden; Switzerland; Thailand; Turkey; Ukraine; the United Kingdom; the United States; Vietnam

Low- and Middle-Income Country subset using WB 1987 classification from:
https://datahelpdesk.worldbank.org/knowledgebase/articles/906519-world-bank-country-and-lending-groups

Argentina; Bangladesh; Belarus; Brazil; Chile; China; Colombia; Czech Republic; Greece; Hungary; Indonesia; India; Republic of Korea; Lithuania; Mexico; Malaysia; Peru; the Philippines; Poland; Portugal; Romania; Slovak Republic; Slovenia; South Africa; Thailand; Turkey; Ukraine; Vietnam

72 non-oil major countries from the World Development Indicators data:

Albania; Argentina; Armenia; Australia; Austria; Bangladesh; Belarus; Belgium; Bolivia; Botswana; Brazil; Bulgaria; Cameroon; Chile; China; Colombia; Costa Rica; Croatia; Cyprus; Czech Republic; Denmark; Dominican Republic; Egypt; El Salvador; Finland; France; Germany; Greece; Guatemala; Honduras; Hong Kong SAR; China; Hungary; India; Indonesia; Israel; Italy; Japan; Jordan; Kenya; Korea; Rep., Kyrgyz Republic; Lebanon; Malaysia; Mauritius; Mexico; Moldova; Morocco; Namibia; the Netherlands; Nicaragua; Norway; Pakistan; Panama; Paraguay; Peru; the Philippines; Poland; Portugal; Romania; Serbia; Singapore; South Africa; Spain; Sri Lanka; Sweden; Switzerland; Thailand; Turkey; United Arab Republic; the United Kingdom; the United States; Uruguay; Vietnam

Appendix 2. List of Unskilled and Skilled Sectors

Low-Skill Sectors		
HS2	**Description**	**Skill Index**
52	Cotton	8.16
53	Other Fibers	8.41
67	Prepared Feathers and Down and Articles	8.95
46	Manufactures of Straw	8.98
45	Cork and Cork Products	9.20
64	Footwear	9.31
50	Silk	9.36
63	Other Textile Products	10.35
55	Man Made Fibers	10.55
58	Woven Fabrics	10.62
65	Headgear	10.74
41	Raw Hides and Skins	11.07
62	Apparel Not Knitted	11.24
44	Wood and Wood Products	11.42
42	Leather Products	11.65
89	Boats and Floating Structures	12.02
61	Apparel Knitted	12.11
56	Wadding	12.24
51	Wool	12.43
66	Umbrellas	12.77
49	Printed Books	12.86
71	Pearls, Gems, And Precious Stones	12.99
57	Carpets	13.45
92	Musical Instruments	13.46
60	Knitted Fabrics	13.61
69	Ceramic Products	13.64
59	Impregnated, Coated, Covered or Laminated Textile Fabrics	13.66
94	Furniture	13.74
96	Misc. Manufactured Articles	14.36
54	Man Made Filaments	14.43
73	Iron and Steel Products	14.51
76	Aluminum & Articles of Aluminum	14.78
83	Misc. Articles of Base Metals	15.14
93	Arms and Ammunition	15.15

High-Skill Sectors		
HS2	**Description**	**Skill Index**
80	Tin and Articles of Tin	15.30
40	Rubber and Rubber Products	15.38
84	Machinery and Mechanical Appliances	15.54
82	Tools & Implements, Cutlery	15.78
88	Aircraft	15.83
72	Iron and Steel	15.87
95	Toys	15.96
68	Articles of Stone	15.98
79	Zinc & Articles of Zinc	16.21
87	Auto and Auto Parts	16.75
43	Fur skins And Artificial Furs	16.83
75	Nickel & Articles of Nickel	17.13
31	Fertilizers	17.57
78	Lead & Articles of Lead	17.67
70	Glass and Glass Wear	17.83
81	Other Base Metals and Their Articles	17.97
36	Explosives	18.22
85	Electrical Machinery and Equipment	18.58
86	Railway Locomotives and Parts	18.86
90	Optical Products	19.25
91	Clocks	19.44
74	Copper & Articles of Copper	19.60
28	Inorganic Chemicals	20.26
39	Plastics and Plastic Products	21.36
32	Tanning or Dyeing Extracts	23.06
48	Paper and Paperboard	24.03
38	Misc. Chemical Products	27.46
47	Wood Pulp	28.57
29	Organic Chemicals	30.65
33	Essential Oils	32.63
35	Albuminoidal Substances	33.80
34	Soap	38.69
37	Photographic or Cinematographic Goods	41.85
30	Pharmaceutical Products	43.49

Appendix 3: Contribution Analysis Using Latest Official Data

In late 2018, the government released data for the 2004–05 to 2011–12 period based on back-casting the post-2011-12 methodology and with 2011–12 as the new base. In doing so, it rejected the estimates of the National Statistical Commission headed that had been created for the purpose of this back-casting exercise. The average growth for the period based on the 2004–05 base was 7.7 percent, growth based on the NSC's back-casting yielded average growth that was even higher at 8.0 percent, while the official data now suggests growth of 6.8 percent, lower than both those estimates. The new numbers elicited a great deal of controversy (Ahluwahlia, 2018: https://www.livemint.com/Opinion/yFCdgIbFiEuZRTxrTo8Y4J/Rewriting-economic- history-The-perils-of-GDP-backcasting.html)

Hence, in the text we used the older official data. This appendix reproduces Table 1 from the text but uses current official data. That means for the period 2004-05 to 2011–12, data are based on the 2011–12 base and methodology rather than the 2004–05 base and the pre-2011–12 methodology. The other change is that real investment and government are not deflated by the CPI as in Table 1.

	PERCENTAGE POINTS				SHARE OF TOTAL		
Period	**Government consumption**	**Investment**	**Exports**		**Government consumption**	**Investment**	**Exports**
1981–1990	0.71	1.48	0.32		28%	59%	13%
1992–2001	0.77	1.55	0.79		25%	50%	25%
2002–2011	0.83	2.94	1.78		15%	53%	32%
2012–2018	0.76	2.10	0.73		21%	58%	20%

Appendix 4. The Indian Model and GDP Measurement

The conclusion that exports are critical to India's growth depends crucially on the measurement of India's GDP growth. Suppose, for example, that the official estimates of GDP growth after 2011 are accurate. In that case, the contribution of exports to growth would decline and the correlation between real GDP growth and export growth for that period would also decline. Not only would growth have occurred without export and import growth, it also would have occurred with very little investment growth. The Indian model would then be unique because it would be a case of growth being driven without any of the usual autonomous drivers—investment, exports, or government consumption—and would be a case of consumption-driven growth. Is this plausible, recalling that even the growth of the 1980s had two autonomous drivers, investment and government consumption?

Subramanian (2019a, 2019b) argues that the behavior of major macro-correlates of GDP growth both within India across time and across countries suggests that GDP growth after 2011–2012 was overstated. These comparisons were mostly between the post-2011 period and the decade before. Figure 3 suggests that that intuition applies more broadly even if the post-2011 period were compared with the 1990s and 1980s. The post-2011 GDP growth line is, for the first time, well above the underlying demand correlates, whereas for the other periods it lies somewhere between them.

Another way of checking this is to examine the consumption growth implied by the official estimates. The table below presents estimates for consumption growth for two periods for which a variety of estimates are available. If the post-2011 GDP official growth estimate were correct, it implies a private consumption growth number that would:

- Exceed GDP growth for the first time;
- Imply an increase in consumption growth relative to the boom period of the 2000s despite IIP (consumption) growth's being almost half that in the boom period and the gross value-added of consumer services having declined by over 3 percentage points; and
- Exceed the consumption growth from the comparable National Sample Survey (NSS) consumption round by a record margin: 6.1 percentage points relative to 0.7 percentage points for the previous NSS round.

Estimates of growth of consumption and proxies
(annual average; percent)

	2004–05 to 2011–12	*2011–12 to 2017–18*
Consumption from national income accounts*	6.2	7.2
Consumption from NSS consumption survey*	5.5	1
Index of industrial production (consumer goods) *	9.3	4.8
Gross value added of private consumer services	8.6	5.5
Consumption from national income accounts (corrected) *	6.2	3.7

*Estimates from Sandefur et. al. (2019). IIP (consumer goods) is a measure of the production (not consumption) of consumer goods. Similarly, GVA of private consumer services is a measure of the production (not consumption) of consumer services: even though this is measured on the production side, it is less prone to deflator issues because the CPI is used (see Ministry of Finance, 2015; Chapter 1, Box. 3)

Appendix 5. Global Market Share Decomposition

In this appendix, we will show that change in the aggregate GMS is a weighted average of change in sectoral GMSs and a term that depends on world growth of exports (external demand factors). Let India's and the world's exports in sector s be denoted by x_s^I and x_s^W respectively. Further, denote India's and the world's total exports by $X^I = \sum_s x_s^I$ and $X^W = \sum_s x_s^W$ respectively. Let us also define change in India's GMS of sector $s$as $\Delta GMS^s = \frac{\Delta x_s^I}{x_s^I} - \frac{\Delta x_s^W}{x_s^W}$

Now, change in India's Global Market Share of aggreagate exports can be written as:

$$\begin{aligned}
\Delta GMS^{Agg} &= \frac{\Delta X^I}{X^I} - \frac{\Delta X^W}{X^W} \\
&= \frac{\sum_s \Delta x_s^I}{\sum_s x_s^I} - \frac{\sum_s \Delta x_s^W}{\sum_s x_s^I} \\
&= \frac{\sum_s x_s^I \frac{\Delta x_s^I}{x_s^I}}{\sum_s x_s^I} - \frac{\sum_s x_s^W \frac{\Delta x_s^W}{x_s^W}}{\sum_s x_s^I} \\
&= \sum_s \sigma_s^I \frac{\Delta x_s^I}{x_s^I} - \sum_s \sigma_s^W \frac{\Delta x_s^W}{x_s^W},
\end{aligned}$$

where σ_s^i is country $i's$ share of sector s exports in its total exports. We can further write:

$$\begin{aligned}
\Delta GMS^{Agg} &= \sum_s \sigma_s^I \frac{\Delta x_s^I}{x_s^I} - \sum_s \sigma_s^W \frac{\Delta x_s^W}{x_s^W} \\
&= \sum_s \left(\sigma_s^I \frac{\Delta x_s^I}{x_s^I} - \sigma_s^W \frac{\Delta x_s^W}{x_s^W} \right) = \sum_s \sigma_s^I \left(\frac{\Delta x_s^I}{x_s^I} - \frac{\sigma_s^W}{\sigma_s^I} \frac{\Delta x_s^W}{x_s^W} \right) \\
&= \sum_s \sigma_s^I \left(\frac{\Delta x_s^I}{x_s^I} - \frac{\Delta x_s^W}{x_s^W} + \frac{\Delta x_s^W}{x_s^W} - \frac{\sigma_s^W}{\sigma_s^I} \frac{\Delta x_s^W}{x_s^W} \right) \\
&= \sum_s \sigma_s^I \left(\Delta GMS^s + \frac{\Delta x_s^W}{x_s^W} - \frac{\sigma_s^W}{\sigma_s^I} \frac{\Delta x_s^W}{x_s^W} \right) \\
&= \sum_s \sigma_s^I \left(\Delta GMS^s + \frac{\Delta x_s^W}{x_s^W} \left(\frac{\sigma_s^I - \sigma_s^W}{\sigma_s^I} \right) \right) \\
\Delta GMS^{Agg} &= \sum_s \left[\underbrace{\sigma_s^I \Delta GMS^s}_{A} + \underbrace{\frac{\Delta x_s^W}{x_s^W} \left(\sigma_s^I - \sigma_s^W \right)}_{B} \right].
\end{aligned}$$

LHS: Change in India's Aggregate Global Market Share (India Growth − World Growth)

RHS A: Share of sector s in India's total exports σ_s^I multiplied by Change in India's global market share of sector s.

RHS B: World growth of exports of sector s, multiplied by the difference in share of sector s in India exports and in World exports

In the data, we find that B is "small" and hence:

$$\Delta GMS^{Agg} \approx \sum_s \left[\underbrace{\sigma_s^I \Delta GMS^s}_{A} \right].$$

This allows us to focus only on the sectoral GMS in the analysis.

Appendix 6. Openness Indicators for the Top 50 Exporters
(Averages over 2015–2018)

Country	*Exports of goods and services/GDP*	*Exports of goods/GDP*	*Trade in goods and services/GDP*	*GDP (constant 2010 US$; billions)*
China	19.9	18.1	37.9	9,874
United States	12.2	8.1	27.2	17,222
Germany	46.9	38.4	86.8	3,826
Japan	17.5	14.0	34.6	6,082
Korea, Rep.	41.4	35.8	77.1	1,390
France	30.9	21.5	62.6	2,849
Hong Kong	190.0	158.5	378.7	276
Netherlands	82.5	61.3	155.1	912
Italy	30.3	24.8	57.7	2,104
United Kingdom	29.3	15.6	59.9	2,811
Singapore	173.0	122.6	319.1	316
Mexico	37.2	34.9	76.2	1,270
Switzerland	64.8	46.5	118.1	653
Spain	34.5	23.8	65.6	1,481
India	19.4	12.1	41.5	2,565
Belgium	80.6	57.4	160.2	526
Thailand	66.6	51.4	121.8	417
Poland	52.9	42.1	102.1	591
Australia	20.6	16.3	41.8	1,365
Brazil	13.2	11.0	26.3	2,302
Vietnam	97.7	91.3	193.0	170
Malaysia	68.8	57.2	130.5	356
Turkey	24.9	19.7	52.6	1,164
Sweden	44.0	30.6	85.0	571
Indonesia	20.3	16.7	40.4	1,066
Austria	53.8	37.9	104.0	427
Czech Republic	79.7	67.2	152.5	236

Denmark	54.9	33.7	103.2	357
Norway	37.0	26.3	69.8	478
Hungary	86.8	68.2	166.5	153
South Africa	30.1	25.5	59.9	424
Chile	28.6	25.0	56.9	272
Finland	36.6	25.8	73.9	260
Romania	41.3	30.5	84.3	209
Portugal	41.8	27.1	82.8	237
Argentina	12.2	10.2	26.1	452
Israel	29.8	17.1	58.0	293
Philippines	28.4	14.6	65.3	310
Peru	23.5	20.3	46.7	196
Colombia	15.4	12.8	36.6	371
Bangladesh	16.0	15.0	38.4	175
Greece	32.7	15.3	65.9	247
Bulgaria	65.3	49.2	127.4	58
Belarus	64.4	50.7	128.5	61
Pakistan	9.2	7.9	27.0	234
Egypt, Arab Rep.	14.6	8.2	39.6	267
Morocco	36.5	19.3	82.5	118
Serbia	48.8	34.6	104.3	46
Panama	43.5	23.4	91.1	46
Croatia	48.6	23.3	97.0	62

Appendix 7. Gravity Model and Openness

A typical gravity equation is of the form:

$$T_{ij} = kY_i^{\alpha} Y_j^{\beta} D_{ij}^{-\gamma},$$

where T_{ij} is the trade between countries i and j. Y denotes their GDP and D the distance between them. The distance can just be physical distance but could also include discontinuous factors such as free-trade agreements. In a symmetric world ($\alpha = 1, \beta = 1, \gamma = 0$), when a buyer is equally likely to buy from any country in world, this equation has a stark result.

$$\frac{T_{ij}}{Y_i} = k(1 - s_i),$$

where s_i is the share of i's income in the world's income. The above equation implies that the trade-to-GDP ratios of larger countries is smaller (Krugman, 1995). Of course, since this is true in a symmetric world and when all conditions outside of trade models are equal, while testing this in the data we must control for factors that could affect both GDP and trade.

Therefore, we regress trade to GDP ratios, averaged over three-year periods to minimize effects of outlier years, on average GDP of the country, controlling for market access of that country, measures of the level of development, and long-run measures of institutions and technology.

Market access controls for cross-country differences in market potential of a country. We use two variables. The first one relates to geographic distance from small or large trading partners (as in Harris, 1954; Donaldson and Hornbeck 2016; Allen and Atkin 2016):

$$MA_i = \sum_{i \neq j} \frac{Y_j}{D_{ij}}.$$

The second one relates to FTAs/RTAs with partner countries. For each country, we compute the average number of signed FTAs weighted by the GDP of partner countries, implying that an FTA with a larger trading partner matters more for trade (similar to Goldberg and Reed, 2020).

As in Goldberg and Reed (2020) to control for long-run measures of institutions or technology, we control for type of climate, distance to the coast, and ruggedness (Nunn and Puga, 2012), as tropical countries have had poor long term economic performance for various reasons (Sachs, 2001; Acemoglu, Johnson, and Robinson; 2001). We further control for the level of agricultural productivity and life expectancy at birth to control the differential level of development in each country (Lewis, 1954).